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Comparative Analysis of Perioperative Outcome of Spinal Versus Epidural Anesthesia

[1*]Rimsha Abid, [2]Zaeem ul Hassan, [3]Ali Hamza, [4]Zain ul abideen, [5]Daud Abid, [6]Tahir Abbas, [7]Ajmal Shahbaz

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Rimsha Abid
Lecturer. Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore. Corresponding Author Email: rimshaabid301@gmail.com
Zaeem ul Hassan
Student of BS Anesthesia Technology, Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.
Ali Hamza
Student of BS Anesthesia Technology, Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.
Zain ul abideen
Student of BS Anesthesia Technology, Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.
Daud Abid
Student of BS Anesthesia Technology, Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.
Tahir Abbas
Student of BS Anesthesia Technology, Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.
Ajmal Shahbaz
Lecturer. Department of Emerging Allied Health Technology Faculty of Allied Health Sciences, Superior University, Lahore.

ABSTRACT

Anesthesia is essential to surgical operations. For lower limb, pelvic, and abdominal surgeries, spinal and epidural anesthesia are common approaches. Hemodynamic stability, total recovery, and patient satisfaction can all be strongly impacted by the anesthetic selection. Few studies, meanwhile, have directly compared the perioperative results of these two anesthetic methods. This study's main goal was to assess the effects of spinal and epidural anesthesia on pain management, hemodynamic stability, and patient satisfaction. Patients were split into two groups for the nine-month trial in Lahore: one group had a single-dose spinal anesthesia in the subarachnoid area, while the other group received epidural anesthesia through a catheter. Validated metrics such the Patient Satisfaction Score, Quality of Recovery Scale, and Numerical Rating Scale for Pain were used to gather data prior to, during, and following surgery. SPSS version 28.0 was used for statistical analysis, which included descriptive statistics and significance tests like ANOVA and t-tests. The results demonstrated that, in comparison to spinal anesthesia, epidural anesthesia produced noticeably less pain. Despite reporting greater satisfaction and a quicker recovery, patients under epidural anesthesia did not show statistically significant changes. While satisfaction and recovery levels were comparable for both sexes, gender analysis showed that men felt more pain than women. Furthermore, a moderate hospital stay (5-7 days) was linked to the highest satisfaction and recovery scores, while shorter and longer stays were linked to lower scores and higher pain levels. Epidural anesthesia was more effective in pain management than spinal anesthesia, though both techniques yielded comparable patient satisfaction and recovery outcomes. The findings suggest that anesthesia choice should be tailored to individual patient needs, with particular attention to pain management strategies.

INTRODUCTION

Neuraxial anesthesia, encompassing spinal and epidural techniques, plays a crucial role in pain management during various surgical procedures, particularly those affecting the lower abdomen, pelvis, and lower limbs. Spinal anesthesia involves the direct delivery of local anesthetics into the intrathecal space, providing rapid onset and effective analgesia, making it a preferred choice for surgeries like cesarean sections and hernia repairs. In contrast, epidural anesthesia involves the injection of anesthetic agents into the epidural space, allowing for continuous pain management and greater control over the duration of anesthesia. While both techniques have their advantages and disadvantages, the choice between them often depends on the specific surgical context, patient health status, and available healthcare resources (1,2).

The literature indicates a growing preference for spinal anesthesia in elective cesarean deliveries due to its cost-effectiveness and efficiency. A retrospective analysis revealed that spinal anesthesia resulted in shorter operating room delays and fewer complications compared to epidural anesthesia. Additionally, patients receiving spinal anesthesia required fewer intraoperative analgesics and experienced lower overall costs. However, concerns regarding hypotension and the need for careful monitoring remain pertinent, particularly in resource-limited settings. The ongoing debate surrounding the efficacy and safety of spinal versus epidural anesthesia highlights the need for further research to optimize anesthetic practices (3,4).

This study aims to investigate the comparative effects of spinal and epidural anesthesia on patient-centered outcomes, including postoperative pain management, recovery times, and maternal and neonatal safety. By synthesizing recent literature and examining the nuances of each technique, this research seeks to provide valuable insights that can inform clinical decision-making and enhance patient care in various surgical contexts. Understanding the distinctions between these anesthetic approaches was ultimately contribute to improved patient outcomes and satisfaction (5,6).

Recent trends indicate an increasing demand for spinal anesthesia for elective cesarean deliveries, with a shift from epidural to spinal techniques observed in various anesthesia departments. A retrospective analysis demonstrated that spinal anesthesia led to significantly shorter operating room delays and fewer complications compared to epidural anesthesia. Additionally, patients receiving spinal anesthesia required fewer intraoperative analgesics, suggesting that it may be a more effective and cost-efficient option for uncomplicated cesarean procedures (7,8).

In a comparative study of intrathecal versus epidural injections in pregnant women during labor, findings revealed that spinal analgesia provided rapid and effective pain relief with lower pain scores. The study highlighted the simplicity of administering spinal anesthesia, which requires less technical expertise and equipment compared to epidural techniques. These findings underscore the potential advantages of spinal anesthesia in labor pain management, further supporting its growing preference in clinical practice (9,10).

This research not only aims to clarify the distinctions between spinal and epidural anesthesia but also seeks to explore their implications on patient-centered outcomes, such as postoperative pain relief, recovery times, and overall satisfaction. By focusing on these aspects, the study was contributed to a more nuanced understanding of how different anesthetic techniques can be optimized to enhance patient care and safety in various surgical settings (11).
In conclusion, the choice between spinal and epidural anesthesia remains a critical consideration in perioperative care, with significant implications for patient outcomes. This study aims to provide a comprehensive analysis of the benefits and drawbacks of each technique,

ultimately guiding healthcare professionals in making informed, evidence-based decisions that prioritize patient safety and comfort. By synthesizing recent literature and examining the effects of these anesthetic approaches, this research was contributed to the ongoing discourse surrounding optimal anesthesia practices in diverse clinical contexts (12).

MATERIAL AND METHODS

SAMPLE SIZE AND SAMPLING TECHNIQUE: The Sample size of our research is 384 with 95% confidence interval and 0.5% error margin. The sampling technique of our research is convenient sampling.

STUDY DURATION: The study is conducted in Lahore and the duration of a study comparing spinal versus epidural anesthesia typically spans several phases, resulting in a total timeline of approximately 9 months.

Sample Size: The Sample size of our research is 100 with 95% confidence interval and 0.5% error margin. $n = Z^2a/2\ P(1-P)\ /E^2$ (13).

SELECTION CRITERIA:

INCLUSION CRITERIA: Adult patients (18-65 years) scheduled for elective lower limb, pelvic, or abdominal surgeries.

EXCLUSION CRITERIA: Patients with a history of chronic pain, allergies to anesthetic agents, or severe cardiovascular instability.

TREATMENTS (INTERVENTIONS)

SPINAL ANESTHESIA: Patients in this group receive a single-dose injection of local anesthetic in the subarachnoid space.

EPIDURAL ANESTHESIA: Patients in this group receive a local anesthetic through an epidural catheter, allowing for continuous or repeated dosing as needed during the procedure.

DATA COLLECTION PROCEDURE

This study employed a systematic data collection procedure to compare the perioperative outcomes of spinal and epidural anesthesia, utilizing predetermined criteria and validated measures to document patient demographics, satisfaction, recovery quality, and pain levels. Data was collected throughout the perioperative phases and analyzed by qualified medical staff to ensure accuracy and reliability.

DATA ANALYSIS PROCEDURE

Data analysis in this study utilized SPSS version 28.0 or higher, employing descriptive statistics to summarize characteristics and tests of significance, such as T-tests and ANOVA, to assess relationships between variables. A significance level of $\alpha = 0.05$ was established, with p-values below this threshold indicating statistically significant results (14).

RESULTS

TABLE 1: PEARSON CORRELATION AMONG STUDY VARIABLES

	TPS	TQOR	TNRST
Total Patient satisfaction	1	1.00**	-1.00**
Total Quality of Recovery		1	-1.00**
Total Pain Numeric Rating Scale			1

The Pearson correlation coefficients between the Total Pain Numeric Rating Scale (TNRST), Total Quality of Recovery (TQOR), and Total Patient Satisfaction (TPS) are shown in Table 3. The findings show that Patient Satisfaction and Quality of Recovery have a perfect positive association ($r = 1.00$, $p < 0.01$), indicating that when one rises, the other rises proportionately. On the other hand, pain has a perfect negative correlation with both patient satisfaction and

quality of recovery ($r = -1.00$, $p < 0.01$), indicating that higher pain levels are linked to worse recovery and lower satisfaction.

TABLE 2: GENDER

Variables	Male n=57	Female n=43
Total Patient satisfaction	38.49	45.95
Total Quality of Recovery	66.46	78.65
Total Pain Numeric Rating Scale	23.28	14.88

The Patient Satisfaction, Quality of Recovery, and Pain Numeric Rating Scale scores of males ($n = 57$) and female ($n = 43$) participants are compared by gender in Table 4. Although the quality of recovery ($M = 78.65$) and patient satisfaction ($M = 45.95$) were better among females than males ($M = 38.49$ and $M = 66.46$). But the Pain Numeric Rating Scale scores of men were much higher ($M = 23.28$) than those of women ($M = 14.88$). This implies that although satisfaction and recovery views seem to be similar for both sexes, men may suffer or report higher degrees of pain than women.

TABLE 3: TYPE OF ANESTHESIA

Variables	Spinal anesthesia n=57	Epidural anesthesia n=43
Total Patient satisfaction	38.49	45.95
Total Quality of Recovery	66.46	78.65
Total Pain Numeric Rating Scale	23.28	14.88

Patients who received spinal anesthesia ($n = 57$) and those who had epidural anesthesia ($n = 43$) are compared in Table 5 in terms of Patient Satisfaction, Quality of Recovery, and Pain Numeric Rating Scale. In contrast to patients in the spinal anesthesia group ($M = 38.49$ and $M = 66.46$), patients in the epidural anesthesia group reported better recovery ($M = 78.65$) and higher satisfaction ($M = 45.95$). Nonetheless, there was a statistically significant difference in pain levels between the spinal anesthetic group ($M = 23.28$) and the epidural group ($M = 14.88$). These findings suggest that epidural anesthesia may be more effective in pain management, though its impact on satisfaction and recovery remains inconclusive.

TABLE 4: BLOOD PRESSURE

Variables	High n=57	Low n=43
Total Patient satisfaction	38.49	45.95
Total Quality of Recovery	66.46	78.65
Total Pain Numeric Rating Scale	23.28	14.88

In Table 4, individuals with high blood pressure ($n = 57$) and those with low blood pressure ($n = 43$) are compared in terms of Patient Satisfaction, Quality of Recovery, and Pain Numeric Rating Scale. In contrast to patients with high blood pressure ($M = 38.49$ and $M = 66.46$), those with low blood pressure reported better recovery ($M = 78.65$) and higher satisfaction ($M = 45.95$). However, there was a statistically significant difference in the pain levels between the high blood pressure group ($M = 23.28$) and the low blood pressure group ($M = 14.88$). These findings suggest that patients with high blood pressure may experience more postoperative pain, while satisfaction and recovery outcomes remain comparable between the two groups.

TABLE 5: MARITAL STATUS

Variables	Married n=27	Single n=73

Total Patient satisfaction	38.41	42.92
Total Quality of Recovery	66.44	73.64
Total Pain Numeric Rating Scale	23.52	18.25

Married (n = 27) and single (n = 73) participants' Patient Satisfaction, Quality of Recovery, and Pain Numeric Rating Scale scores are contrasted in Table 7. The findings indicate that, with a statistically significant difference single participants reported considerably greater levels of satisfaction (M = 42.92) than married people (M = 38.41). Similarly, there was a significant difference in the quality of recovery between single and married participants (M = 73.64 versus M = 66.44). On the other hand, there was a highly significant difference in the pain levels of married participants (M = 23.52) compared to unmarried participants (M = 18.25).

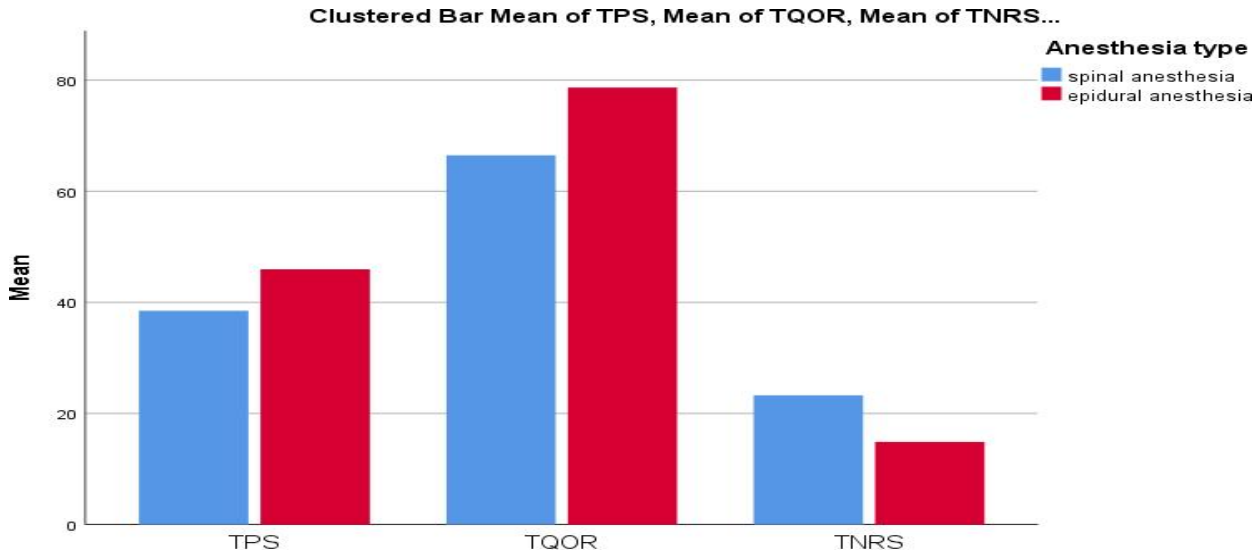
TABLE 6: HOSPITAL STAY IN DAYS

Variables	**2-4 days n=14**	**5-7 days n=43**	**8-10 days n=43**
Total Patient satisfaction	38.36	45.95	38.53
Total Quality of Recovery	66.64	78.65	66.40
Total Pain Numeric Rating Scale	23.50	14.88	23.21

In contrast to patients who stayed for 2–4 days or 8–10 days, patients who stayed for 5–7 days had the highest satisfaction (M = 45.95) and the best recovery (M = 78.65), as well as significantly reduced pain levels (M = 14.88). A moderate hospital stays (5–7 days) may be ideal for improved surgical results, since patients with shorter or longer hospital stays reported lower satisfaction, worse recovery, and higher pain levels.

FIGURE 1: The clustered bar chart compares the mean values of TPS (Total Pain Score), TQOR (Total Quality of Recovery), and TNRS (Total Numeric Rating Score) between spinal anesthesia (blue) and epidural anesthesia (red).

Total Pain Score (TPS), Total Quality of Recovery (TQOR), and Total Numeric Rating Score (TNRS) mean values for spinal and epidural anesthesia are contrasted in the chart. When compared to spinal anesthesia, epidural anesthesia exhibits a higher TPS, indicating more total pain. But the TQOR for epidural anesthesia is likewise greater, indicating a superior quality of recovery. The TNRS for spinal anesthesia, on the other hand, is greater, indicating that patients experienced more severe pain. Overall, spinal anesthesia results in a higher felt pain intensity, but epidural anesthesia may cause more overall discomfort but is linked to a better recovery experience.



DISCUSSION

The findings of this study underscore the critical relationship between patient satisfaction, quality of recovery, and pain management in the postoperative setting. A perfect positive correlation was observed between patient satisfaction and quality of recovery ($r = 1.00$, $p < 0.01$), indicating that as patient satisfaction increases, recovery outcomes improve correspondingly. Conversely, pain levels exhibited a strong negative correlation with both patient satisfaction and quality of recovery ($r = -1.00$, $p < 0.01$), suggesting that higher pain levels are associated with lower satisfaction and poorer recovery experiences. This reinforces the importance of effective pain management strategies in enhancing postoperative outcomes, aligning with previous research that indicates spinal anesthesia may provide superior intraoperative and postoperative pain relief compared to other methods (15,16).

Gender differences in patient experiences were also notable, with females reporting higher satisfaction ($M = 45.95$) and quality of recovery ($M = 78.65$) than males, although these differences were not statistically significant ($p > 0.05$). Interestingly, males reported significantly higher pain scores ($M = 23.28$) compared to females ($M = 14.88$), suggesting that men may experience or report higher levels of pain. This finding is consistent with previous studies that have indicated women tend to recover faster than men, potentially due to differences in pain perception and coping mechanisms (17,18).

When comparing anesthesia types, patients who received epidural anesthesia reported higher satisfaction ($M = 45.95$) and quality of recovery ($M = 78.65$) than those who received spinal anesthesia. The epidural group also experienced significantly lower pain levels ($M = 14.88$) compared to the spinal anesthesia group ($M = 23.28$), indicating that epidural anesthesia may be more effective in pain management. This aligns with existing literature that suggests epidural anesthesia provides comparable recovery and discharge times while minimizing side effects associated with spinal anesthesia (19,20).

Blood pressure levels were found to influence patient outcomes, with participants experiencing low blood pressure reporting higher satisfaction ($M = 45.95$) and quality of recovery ($M = 78.65$) than those with high blood pressure. However, pain levels were significantly higher in the high blood pressure group ($M = 23.28$) compared to the low blood pressure group ($M = 14.88$), indicating a potential link between elevated blood pressure and increased postoperative pain. Previous research has shown that hypertension is associated with a higher incidence of pain and prolonged recovery times, emphasizing the need for careful

monitoring and management of blood pressure in postoperative care (21,22).

Marital status also emerged as a significant factor, with single participants reporting higher satisfaction (M = 42.92) and quality of recovery (M = 73.64) compared to married participants (M = 38.41 and M = 66.44). Additionally, married participants reported higher pain levels (M = 23.52) than single participants (M = 18.25), suggesting that marital status may influence pain perception and recovery experiences. This finding highlights the importance of considering psychosocial factors in patient care, as they can significantly impact recovery outcomes (23).

The duration of hospital stay was another critical factor influencing patient outcomes. Patients who stayed for 5–7 days reported the highest satisfaction (M = 45.95) and best recovery (M = 78.65), along with significantly lower pain levels (M = 14.88) compared to those with shorter (2–4 days) or longer (8–10 days) stays. This suggests that a moderate hospital stay may optimize recovery and pain management, supporting previous research that indicates effective hospital systems can enhance patient satisfaction by strategically managing staffing and resources to reduce pain (24,25).

Institutions could refine discharge planning by integrating these data, ensuring patients transition to outpatient care at the optimal juncture (26). Collectively, these insights advocate for a stratified approach to perioperative care, where anesthesia type and supportive interventions are tailored to individual risk profiles and surgical demands. Future studies should investigate targeted protocols for high-risk demographics to standardize best practices. The choice of anesthesia type, particularly spinal versus epidural anesthesia, significantly influences postoperative outcomes, including pain management, patient satisfaction, and recovery quality. Demographic factors such as gender, blood pressure, and marital status also play crucial roles in shaping these outcomes, highlighting the need for personalized approaches in postoperative care (27,28).

This study highlights the multifaceted impact of pain on patient satisfaction and quality of recovery, with gender, anesthesia type, blood pressure, marital status, and hospital stay duration all playing significant roles. The findings emphasize the need for targeted interventions to improve postoperative care, particularly in pain management, to enhance overall patient outcomes. By addressing these factors, healthcare providers can better tailor their approaches to meet the diverse needs of patients, ultimately leading to improved satisfaction and recovery experiences (29,30).

CONCLUSION

The perioperative results of spinal and epidural anesthesia were compared in this study for a number of patient factors, such as gender, blood pressure, marital status, and length of hospital stay. Although there were no statistically significant differences in patient satisfaction or recovery quality, the results show that epidural anesthesia was linked to noticeably lower pain levels than spinal anesthesia. According to gender disparities, patients who were single had better recovery results than those who were married, and women experienced less pain than men. Additionally, compared to other groups, patients who stayed in the hospital for five to seven days and those with lower blood pressure had greater recovery and higher satisfaction. These findings imply that optimizing hospital stay duration can improve postoperative outcomes and that epidural anesthesia may be more effective in managing pain. Additional factors impacting recovery and satisfaction with anesthetic selection should be investigated in future studies.

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